

A REVIEW OF THE CENTRAL AMERICAN SPECIES
OF PENTACALIA (ASTERACEAE: SENECTIONEAE).

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A number of undescribed species of Senecioneae are known from the Neotropical Region which have remained unworked because of the need for more proper generic alignments in the tribe. One group in particular, the section Streptothamni of Greenman, has been rather consistently recognized within Senecio. The inclination to raise the section to generic rank suffered from a lack of knowledge of a proper name to use and the name Streptothamnus itself is preoccupied at the generic level. A previous series of studies (Robinson and Brettell, 1973a, b, c) reviewed Mexican and Central American Cacalioid elements some of which had previously been placed in Senecio, but Senecionoid elements were not treated. More recently the independent status of the Senecionoid Pseudogynoxys has been restated (Robinson and Cuatrecasas, 1977) leaving the section Streptothamni and the species of "Microchaete" as the only significant elements in Central America still treated as Senecio that do not conform to any natural concept of that genus. Two recent studies have appeared that provide great insight into the Senecioneae, Jeffrey et al. (1977) have provided an outline of natural groupings within Senecio and have listed members of the section Streptothamni in their unit A VI, and Nordenstam (1978b) has provided a number of further insights in the process of reviewing the tribe Senecioneae in the Symposium on the Biology and Chemistry of the Compositae. In a preliminary paper Nordenstam (1978a) segregates a number of new genera such as Odontocline of Jamaica and resurrects older genera such as the Andean Aetheolaena of Cassini.

A search among the many Neotropical Senecioneae has shown that the name Pentacalia Cassini based on Cacalia arborea HBK is the earliest available for the group containing section Streptothamni. The genus was established by Cassini in a casual manner but the type species was cited and a primary distinguishing character was given, the 5-angled achene that was the basis for the generic name. The character which is common in many Asteraceae is not common in the Senecioneae,

but examination shows that it is a common and significant feature of almost all the species recognized in this study as members of the genus. Species with 10 ribs still do not show the completely equal development seen in Senecio.

The distinctions from other genera can be broadly summarized. Enlarged cells of the anther collars and the separated stigmatic lines on the style branches both eliminate close relation to Cacalioid genera such as Nelsonianthus (Robinson and Brettell, 1973a). The blunt tips of the styles differ from those of Pseudogynoxys. The fruticose to scandent habit with woody stems, the distinctly petiolate usually non-stipitate leaves, the minutely fistulose or non-fistulose receptacles, the tails on the anthers and the rather stout 5-ribbed achenes all differ from Senecio. The usually non-stipitate petioles, the erect heads, the tails on the anthers and the lack of a central coma on the style tip indicate a different basic element from what is now called Aetheolaena.

Among genera that seem most closely related is Odontocline Nordenst. of Jamaica which has much the same habit and seems initially identical, being named after the crests on the receptacle that are also common in Pentacalia. The Jamaican genus differs in significant ways, however. The stigmatic surface is bilobed in initial observation but cross-sections show the surface is continuous as indicated by Nordenstam (1978a). The achenes differ by having the more common 8-10-ribbed condition of the tribe. The anther appendages are more ovate to lanceolate while they are mostly oblong in Pentacalia. The tips of the styles of the disk flowers are more produced as shown by Nordenstam and the outer surfaces of the involucre bracts are regularly striated or grooved.

Pentacalia Cassini, Dict. Sc. Nat. 48: 461. 1827.

Senecio sect. streptothamni Greenm., Bot. Jahrb. 32: 19. 1902.

Woody shrubs or vines, often epiphytic. Stems terete or subterete, surface sometimes hardened and whitish or irregularly cracked when dry, becoming corticated when older. Leaves alternate, distinctly petiolate, rarely stipitate; blades ovate to oblong, often carnose, margins entire to minutely denticulate or serrate, nerves pinnate, secondary veins obscure to prominent on lower surface. Inflorescence terminal or lateral, multicapitate, thyrsoïd to corymbose paniculate. Heads erect on pedicels, with few usually small subinvolucre bracts; involucre uniseriate with

5-8 rarely 13 oblong shortly acute phyllaries, median outer surface usually fleshy without regular grooves or striations; receptacle often with prominent small crests. Corollas glabrous, usually yellow; with or without rays; disk corollas with long basal tube, throat tubular to slightly funnelform, lobes longer than wide, oblong-ovate to narrowly oblong, sometimes as long as throat, median resin duct weakly developed; anther collars with larger or thinner walled cells below; anther thecae with tails at base, tails often as long as collars; thecial cells oblong, with numerous minute nodular thickenings on vertical walls and a few on short transverse and oblique walls; anther appendage oblong, rounded at tip, with narrow cells; style with 2 separated stigmatic lines; tip truncate to slightly convex, without distinct central coma of hairs. Achenes prismatic with mostly ca. 5 ribs, rather stout, glabrous, smooth; carpopodium short, incurved at lower margin, sharply demarcated above, with many rows of small cells; pappus of 1-3 series of scabrous capillary bristles, usually narrowed distally to ca. 30 μ wide, with or without enlarged tips. Pollen 30-40 μ in diameter.

Type species: Cacalia arborea H.B.K., Nov. Gen. & Sp. 4: 128, pl. 359. 1818, ed folio, Colombia. Paramo de Almaguer juxta pagum Pansitara. Sept. = Pentacalia arborea (H.B.K.) H. Robinson & J. Cuatrecasas, comb. nov.

The present treatment is restricted to the Central American species. South American species will be treated separately. The present broad interpretation of the genus is based on the comparative utility of the unifying characters versus the more subtle characters or combinations of characters upon which natural segregates could be based. The more typical element of the genus presents a distinctive aspect and has more thyrsoid inflorescences, discoid heads, and receptacles without obvious small crests, but none of the characters is restricted to the group. The prominent secondary leaf veins spreading at nearly right angles provide a more significant but still not unique character. The single Central American species belonging to the typical group is P. phanerandra.

Key to the Central American Species

1. Heads without ray flowers; receptacle often with weak crests or no crests.
2. Leaves with primary and secondary veins prominent on lower surface; heads with 10-14 flowers.

3. Leaves with secondary veins sharply spreading at near 80° angles, leaf margins often with few to many small dentations; pappus distinctly in 2 or more series; inflorescence puberulous with coarse hairs P. phanerandra
3. Leaves with secondary veins usually ascending at $50-60^{\circ}$ angles, leaf margins entire; pappus mostly in 1 series; inflorescence subtomentose with long-attenuate hairs P. candelariae
2. Leaves carnosae with primary and secondary veins usually obscure; heads with ca. 20 flowers.
4. Involucral bracts 7-8 mm long, mostly as long as the head P. parasitica
4. Involucral bracts 5-6 mm long, shorter than the head P. phorodendroides
1. Heads with ray flowers which are sometimes small; receptacle usually with prominent small crests.
5. Inflorescence with distinct large oblong-elliptical primary bracts to 2 cm long and 1 cm wide P. tonduzii
5. Inflorescence without specialized large primary bracts.
6. Heads broadly campanulate, with 15-25 disk flowers.
7. Leaf blades ca. 13 cm long and 9 cm wide; disk corollas with lobes ca. 1 mm long P. epidendra
7. Leaf blades not over 10 cm long or 5 cm wide; disk corollas with lobes 1.5-2.0 mm long.
8. Leaf blades elliptical with acute apices; tips of pappus setae not enlarged or distorted P. magistri
8. Leaf blades ovate with acuminate tips; tips of pappus setae enlarged or distorted P. morazensis
6. Heads narrowly campanulate with 5-12 disk flowers.

9. Inflorescence lateral with panicles mostly from axils of normal leaves; limbs of rays 2.0-2.5 mm long.
10. Leaves narrowly elliptical; axillary panicles ca. 5 cm long; heads with 8-10 disk flowers
P. horickii
10. Leaves elliptical to oblong-elliptical; axillary panicles 10-20 cm long; heads with ca. 4 disk flowers
P. matagalpensis
9. Inflorescence terminal, broadly corymbose-paniculate; limbs of rays 3-6 mm long.
11. Subinvolucral bracts large, 4-5 mm long, completely covered with dense tomentum
P. calyculata
11. Subinvolucral bracts less than 4 mm long, not more densely pubescent than involucral bracts.
12. Throats of mature disk corollas extending above tips of the pappus bristles; leaves acute
P. wilburii
12. Throats of mature disk corollas not extending above tips of pappus bristles; leaves distinctly acuminate
P. streptothamna

The new species and new combinations of Central American Pentacalia are as follows:

Pentacalia calyculata (Greenm.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio calyculatus Greenm. in J. Donn.-Smith, Bot. Gaz. 37: 419. 1904. Costa Rica.

Pentacalia candelariae (Benth. ex Oersted.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio candelariae Benth. ex Oersted., Kjoeb. Vidensk. Meddel. 1852 (5-7): 108-109. 1852. Costa Rica.

Pentacalia epidendra (L.Wms.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio epidendrus L.Wms., Phytologia 31: 440. 1975. Guatemala.

Pentacalia horickii H. Robinson, sp. nov.

A O. wilburii similis et O. matagalpense valde affinis sed petiolis 7-10 mm longis, laminis anguste

ellipticis ca. 6.5-7.5 cm longis et 1.0-1.4 cm latis base anguste cuneatis apice anguste acuminatis; inflorescentibus axillaribus breviter paniculatis 4-6 cm longis et ca. 3 cm latis, pedicellis 2-9 mm longis minute sparse puberulis, bracteis subinvolucralibus paucis minute linearibus ca. 1 mm longis; capitulis ca. 8 mm altis et 2-3 mm latis; squamis involucri plerumque 5 interdum coalescentibus oblongis ca. 5 mm longis plerumque 1-2 mm latis; receptaculis breviter cristiferis; floribus radiatis 2-3 pallidis, tubis ca. 5 mm longis, limbis minute oblongis ca. 2 mm longis; floribus discis 8-10; corollis pallidis, tubis ca. 3 mm longis, faucis anguste infundibularibus 2.5 mm longis, lobis anguste lanceolatis 1.5-2.0 mm longis et 0.6-0.7 mm latis, cellulis apicalibus scleroideis vix mamilliosis; filamentis in parte superiore ca. 0.7 mm longis base ca. 0.17 mm latis; thecis in parte pollinifero ca. 1.3 mm longis base longe caudatis ad 0.5 mm longis, appendicibus antherarum anguste oblongis ca. 0.5 mm longis et 0.18 mm latis; ramis stylorum in apicem breviter cristatis; achaeniis ca. 1.4 mm longis glabris; setis pappi ca. 5 mm longis apice vix incrassatis, cellulis apicalibus saepe obtusis interdum retrorse scabridis; granis pollinis ca. 35-40 μ in diametro.

TYPE: GUATEMALA: Quezaltenango: Pacific watershed in valley of Río Naranjo, between San Martín Chiquito, Las Nubes south to El Pozo and Chuikabál (Canton Tuhilacán), not quite reaching Mujuliá; at an altitude between 2100 and 1800 meters. Sent with Bonifazia quezaltica collected on "tall trees in dense dark cloud forest interior. Pendent vine most significant for Bonifazia forests, epiphytic." C.K. Horich s.n. prepared 27 May 1960, UC Bot. Gard acc. no. 57.247-1 (Holotype, US).

The species is most obviously distinct from all related species in the narrowly elliptical leaves with narrowly acuminate tips. The species seems superficially similar to P. phorodendroides but the leaf shape, the presence of ray flowers and the smaller number of disk flowers with longer lobes furnish ample distinctions. Of the new species closest relationship is with P. mataglapensis which has similar lateral inflorescences with few flowered heads, similar long tails on the anthers and a similar nearly complete crown of hairs on the tip of the style branches. The latter species differs in the broader leaves, the longer branches of the inflorescence, the coarser pubescence, the larger subinvolucral bracts, the extremely elongate lobes of the disk corollas and the fewer numbers of disk flowers.

Pentacalia magistri (Standl. & L. Wms.) H. Robinson &
J. Cuatrecasas, comb. nov. Senecio magistri
Standl. & L. Wms., Ceiba 4: 190. 1954. Honduras.

Pentacalia matagalpensis H. Robinson, sp. nov.

A O. wilburii similis sed caulibus sparse puberulis subglabrescentibus, petiolis 5-10 mm longis, laminis ellipticis 2.5-5.5 cm longis et 1.0-2.5 cm latis distincte breviter acuminatis; inflorescentibus axillaribus longe paniculatis usque ad 17 cm longis et 8 cm latis, pedicellis brevibus vel subnullis 0-2 mm longis dense puberulis, bracteis subinvolucralibus lanceolatis 1-2 mm longis; capitulis 6-7 mm altis et ca. 2 mm latis; squamis involucri ca. 5 oblongis ca. 5 mm longis et 1 mm latis; receptaculis subcristiferis; floribus radiatis plerumque 2 albis?, tubis ca. 3 mm longis, limbis minute oblongis ca. 2.5 mm longis; floribus discis plerumque 4; corollis albis?, tubis 2.5-3.0 mm longis, faucis anguste infundibularibus 1.0-1.5 mm longis, lobis linearibus 2.5-3.0 mm longis et 0.5 mm latis, cellulis apicalibus scleroideis alte mamillosis; filamentis in parte superiore ca. 0.5 mm longis base ca. 0.2 mm latis; thecis in parte pollinifero 1.3-1.5 mm longis base longe caudatis ad 0.5 mm longis; appendicibus antherarum anguste oblongis ca. 0.4 mm longis et 0.17 mm latis; ramis stylorum in apicem prominentiter cristatis; achaeniis ca. 1 mm longis glabris; setis pappi ca. 5 mm longis apice leniter incrassatis, cellulis apicalibus plerumque obtusis; granis pollinis ca. 35-40 μ in diametro.

TYPE: NICARAGUA: Matagalpa: Cloud forest area at "Disparate de Potter" near Sta. Maria de Ostuma. Cordillera Central de Nicaragua between Matagalpa and Jinotega, Alt. 1500 m. Feb. 20, 24, 1963. Williams, Molina & Williams 25036 (Holotype, US).

Pentacalia matagalpensis is most notable for the elongate axillary panicles with small groups of densely clustered heads. The stems and branches of the inflorescence are more puberulous than in related species and the stems remain sparsely roughened apparently from persistent bases of the hairs. The disk flowers have particularly prominent hairs on the style tips and on the back below the tip. This apical crown extends around to the inner surface above the stigmatic lines. The condition of the style tips is approached in the closely related P. horickii but is markedly distinct from the condition in P. streptothamnus which also occurs in Nicaragua. The flowers were noted as being white by the collectors.

Pentacalia morazensis (Greenm.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio morazensis Greenm., Ceiba 1: 122. 1950. Honduras.

Pentacalia parasitica (Hemsl.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio parasiticus Hemsl., Biol. Cent. Amer., Bot. 2: 244. 1881. Cacalia parasitica Sch. Bip. ex Hemsl., Biol. Cent. Amer., Bot. 2: 244. 1881, nom. nud. in syn. Guatemala, Mexico.

Pentacalia phanerandra (Cufodontis) H. Robinson & J. Cuatrecasas, comb. nov. Senecio phanerandrus Cufodontis, Archivio Bot. Forlì 9: 103. 1933. Costa Rica.

Pentacalia phorodendroides (L. Wms.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio phorodendroides L. Wms., Phytologia 31: 445. 1975. Guatemala.

Pentacalia streptothamma (Greenm. ex Standl.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio streptothamnus Greenm. ex Standl., Field Mus. Pub. Bot. 18: 1518. 1938; Greenm., Bot. Jahrb. 32: 22. 1902, nom. nud. Costa Rica, Nicaragua, Panama.

Pentacalia tonduzii (Greenm. ex Standl.) H. Robinson & J. Cuatrecasas, comb. nov. Senecio tonduzii Greenm. ex Standl., Field Mus. Pub. Bot. 18: 1519. 1938; Greenm., Bot. Jahrb. 32: 22. 1902, nom. nud. Costa Rica.

Pentacalia wilburii H. Robinson, sp. nov.

Plantae lignescentes scandentes epiphyticae. Caules teretes vel subteretes in sicco subangulati glabri, cellulis superficialibus plerumque in strato eburneiformibus induratis. Folia alternata, petiolis 10-17 mm longis; laminae carnosae ellipticae vel obovatae 4.0-6.5 cm longae et 2.0-3.3 cm latae base cuneatae vel acuminatae margine integrae apice breviter acutae supra et subtus glabrae. Inflorescentiae terminales late corymboso-paniculatae 9-14 cm latae, pedicellis 3-10 mm longis sparse puberulis, bracteis subinvolucralibus paucis membranaceis linearibus 3-4 mm longis. Capitula ca. 9 mm alta et 3-4 mm lata; squamae involucris 5-8 oblongae 5-6 mm longae et 1-2 mm latae extus glabrae apice breviter acutae dense breviter setiferae; receptacula breviter cristifera. Flores radii 2-3; corollae flavae, tubis ca. 3.5 mm longis, limbis oblongis ca. 3.5 mm longis et 1.5 mm

latis. Flores disci 5-11; corollae flavae, tubis 3.5-4.0 mm longis, faucis anguste infundibulares 2.0-2.5 mm longis, lobis lanceolatis 1.3-1.7 mm longis et ca. 0.6 mm latis, cellulis apicalibus scleroideis vix mamillosis; filamenta in parte superiore 0.3-0.4 mm longa base ultra 0.2 mm lata; thecae in parte pollinifero ca. 1.5 mm longae base longae caudatae ad 0.7 mm longae; appendices antherarum anguste oblongae ca. 0.4 mm longae et 0.25 mm latae; ramis stylorum subapice extus breviter cristatis. Achaenia 1.5-2.0 mm longa glabra; setae pappi ca. 50 ca. 4 mm longae apice vix incrassatae, cellulis apicalibus breviter acutis. Grana pollinis ca. 35 μ in diametro.

TYPE: PANAMA: Chiriquí: edge of forested slope above Cerro Punta toward Bajo Grande in Quebrado Bajo Grande, about 6500 ft., succulent epiphyte, florets bright yellow. 14 January 1970. R.L. Wilbur, Weaver, Foster & Correa 10919 (Holotype, DUKE; isotype US).

PARATYPES: COSTA RICA: Alajuela: Volcan de Poás, along the road between La Lechería and the Hotel; alt. 2100 to 2600 m. Pendent epiphytic shrub; flowers yellow. Feb. 17, 1924. Standley 34638 (US); San Jose: Cerro Chirripó, elev. 2700-3000 m, oak forest with Chusquea understory. Epiphytic vine; flowers yellow. 6 April 1969. Davidse & Pohl 1643 (US); Carretera Panameri cana, 7000', rays amarillos; tallos rastreras, 27 March 1949. Inst. Interamer. Cienc. Agrícolas Herb. no. 435 (US).

The new species seems nearest to P. streptothamna occurring in the same general area, but the leaves of the latter are acuminate at the tip. The corolla lobes of the new species are shorter in comparison and the throats longer, a feature particularly noticeable in relation to the length of the pappus. The tails of the anthers are among the longest seen in the tribe, being almost twice as long as the anther collars.

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Pentacalia horickii H. Robinson

Specimen sent me for a study of the *Coumarulaceae* and *Sesuviales*

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Pentacalia horickii H. Robinson, Holotype, United States National Herbarium. Photos by Victor E. Krantz, Staff Photographer, National Museum of Natural History.